Country Report The Netherlands 2010
IEA Bioenergy Task 42

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Content

Country introduction

Table 1. Characteristics of The Netherlands in 2009 (CBS, 2010).

	Total area [10^3 km^2]	Population [10^6]	Utilized Agricultural area [10^3 km^2]	Forest land [10^3 km^2]
The Netherlands	41.5	16.486	19.2	3.4

The government identified chances for the Dutch industry, specifically within the field of the production of (high) added-value products from biomass. Based on this, and on the fact that the required biomass has to be produced in a sustainable way, the Dutch government set-up a policy agenda. One of the focus points of it is improving the efficiency of biomass utilisation, with biorefinery as key concept/technology.

The Innovation Agenda Energy (EZ, 2009) gives concrete targets for 2020 in the field of Energy Transition. The scope of the Innovation Agenda Energy is the period 2008-2012. The agenda is aimed primarily at the start-up of the necessary developments within several innovation themes. One of these themes is Bio-based Raw Materials ('Groene Grondstoffen'). This concerns, among others, sustainable production and development of biomass, and co-production of transportation fuels, chemicals, power and heat. Important activities within the theme Bio-based Raw Materials are: drawing up a Dutch (technology) Roadmap Biorefinery, building experience in the defined routes by funding pilot and demonstration ptojects, and organisation of sector meetings..

This Dutch Roadmap Biorefinery describes a number of routes, including both short and midterm opportunities and more strategic actions for the longer-term, towards the development of a Bio-based Economy in The Netherlands. Most promising innovation directions pursue on opportunities that are a good fit to strengths and can cope with weaknesses within the specific Dutch framework. The following promising directions for biorefinery in The Netherlands have been identified:

- Biorefinery based on domestic Dutch crops, using synergy of existing agro and chemical sectors, including the Dutch plant breeding sector.
- Biorefinery of aquatic biomass, using Dutch microbiology, plant breeding and processing knowledge.
- Biorefinery of bulk imported biomass and biomass-derived intermediates, using existing logistic and petrochemical infrastructure.
- Biorefinery of residues, based on co-operation in production chains and networks, relatively small transport distances, and business competences of Dutch entrepreneurs.

Energy production and consumption based on biomass

For the specific Dutch situation, the total amount of biomass used for heat and power purposes was 58.1 PJ avoided fossil fuel use (affu) in 2008 (see Table 2.). Major contributors were cofiring in coal-fired power plants: 28%, combustion of the biogenic part (48%) of domestic waste: 18%, combustion for CHP: 13%, digestion of residues: 10%, and combustion for heat at households: 8%. 58.1 PJ_{affu} in 2008 corresponds to 67 – 77% of the Dutch Policy Goal set for 2010*, so it is assumable that this goal probably will not be met with biomass use for heat and power production alone.

In 2008, in the Netherlands a biofuel blending percentage of about 4% was realised (about 28% bioethanol as gasoline blend and 72% biodiesel). In case we include biofuel-use (12 PJ_{affu} in 2008) – originally no part of the Action Plan Biomass – in the overall bioenergy use in the Netherlands, the total 2010 bioenergy policy goal (about 100 PJ_{affu}) potentially could be met in 2010.

Table 2. Bioenergy – Dutch 2008 Situation vs 2010 Policy Goals (CBS, July 2010).

	2008		2010*
	PJ_{affu}	%	PJ_{affu}
Large scale			
Cofiring power plants	19.7 (22.5)	28 (28)	34
Domestic waste combustion facilities	13.1 (14.0)	18 (18)	20
Small scale			
Combustion – industrial heat	2,5	4	7
Combustion – households	5.5	8	
Combustion – CHP	9.1	13	8 – 18
Landfilling	1.4 (1.3)	2	2
Digestion	6.8 (8.6)	10	4 – 6
Total Heat & Power	**58.1 (63.5)**	**83**	**75 – 87**
Biofuels	**12.0 (15.5)**	**17 (20)**	about 16
Total Bioenergy (incl. Biofuels)	**70.1 (about 80)**	**100**	91 – 103

*2010 Policy Goals as defined in the Dutch Action Plan Biomass (2003); ** biofuels: 4% blending in 2010
(Between brackets): preliminary data 2009; NB: 41.868 PJ = 1 Mtoe

Bioenergy (heat, power and fuels) was the largest contributor (63%) to the total renewable energy use in the Netherlands in 2008 (others: wind: 31%, sun/water/heat pumps: 6%). Taking into account renewable power alone, the bioenergy contribution was 45%, followed by wind (41%) and sun/water (14%). It is generally expected that biomass will be outstripped by wind as primary energy source for the production of renewable power. The use of biomass for the (co)production of both transportation fuels and Biobased Products (chemicals, materials) is expected to increase.

Table 3. Newest (270810) data on 2009 biofuel use in the Netherlands (VROM, 2010)

	Gasoline	Diesel	ethanol	ETBE	Biodiesel	Biodiesel advanced*
Ml	5,720	7,674	22.8	389.3	115.4	106.7
toe	4,461,600	6,599,640	11,628	249,152	92,320	85,360
	11,061,240		260,780		177,680	
			438,460			

The amount of biofuels as percentage of the total amount of gasoline and diesel sold on the Dutch market was 3.81% on energy basis; or **3.75% on energy basis** taking into account a correction value for biofuel blending. About 65% of the energetic contribution of the biodiesel is advanced biodiesel, i.e. biodiesel produced from agroresidues or non-food crops, which may be acounted twice (2003/30/EG).

Gross Dutch biomass availability in 2000

Rabou et al. (2006) calculated the year 2000 Gross Dutch biomass consumption ((import-export) + production) = ((32.8-21.5) + 31): 42.3 Mt db or about 742 PJ_{th}. This equalled to 24% of the Dutch primary energy use in 2000. Only a part of these organic streams were available as fuels for energy and raw materials for chemicals. Based on Meesters et al. (2010) – who made a more detailed and recent assessment – the 2006 domestic biomass production equalled to 27.6 Mt db, and the Gross Dutch biomass consumption ((40-29) + 27.6) = 38.6 Mt db or about 677 PJ_{th}.

Projected Dutch biomass availability for power and heat production in 2020

Koppejan et al. (2009) projected a domestic biomass availability for power and heat production in 2020 of 13.4 – 16.4 Mt db, corresponding to 30-40% of the total biomass consumption in the Netherlands. With the biomass available, potentially 53-94 PJ final energy could produced, corresponding with about 101-157 PJ avoided fossil fuel use (3.4-5.3% of the expected primary energy use in the NL in 2020).

Biomass used for non-energy purposes

Projected Dutch biomass availability for non-food applications in 2030

According to the Long-Term Vision of the Platform Bio-based Raw Materials (in Dutch: Platform Groene Grondstoffen (PGG)) – an advisory committee to the Dutch government – 30% of the fossil resources used as both raw materials and fuels (see Table 3.) should be replaced by bio-based alternatives in 2030 (PGG, 2006a).

Table 4. 2030 Vision 30% substitution goal specified over Dutch market sectors (PGG, 2006a).

Application	Envisaged fossil fuel substitution per application [% of use]	Fossil fuel substitution [PJ_{affu}]	CO_2-emission reduction [Mt/a]
Chemicals & Materials	25	140	11
Fuels for transport	60	324	24
Power	25	203	14
Heat	17	185	10
	Sum	852	59

An important constraint of this LT Vision is that the overall energy consumption in 2030 should not exceed that of the year 2000, viz. 3000 PJ_{th}. To realise the 2030 LT Vision a combined package of measures is necessary, a.o. an increase in overall energy efficiency, reduced energy consumption, and offering a framework to enable the large-scale transition towards a Bio-based Economy. The substitution of about 850 $PJ_{th,\ affu}$ of fossil fuels will require about 1200 PJ_{th} raw biomass materials, corresponding to about 80 Mt dry base per year. For the non-energy part these data are: 140 $PJ_{th,\ affu}$ will required about 175 PJ_{th} raw biomass materials, corresponding to about 12 Mt dry base per year.

Part of the future total biomass demand for non-food applications (80 Mt db/year in 2030) can be filled in with biomass available in The Netherlands. The projection of the Dutch biomass availability for non-food applications in 2030 is: 6 Mt dry base primary by-products/residues (100 PJ_{th}), 12 Mt dry base secondary by-products/residues (200 PJ_{th}), and 0 to 9 Mt dry base energy crops (0 – 150 PJ_{th}); added total: 18 – 27 Mt dry base or 300 – 450 PJ_{th}.

To meet the 2030 Vision, all available domestic biomass resources should be made available, incl. the full use of the aquatic biomass potential. Even then, about 50% of the biomass requirements should be covered by import of densified raw materials and/or biomass-derived intermediates. The nationally available biomass for non-food applications, however, is enough to meet the Vision goal for biomass applications in the high-added value chemicals/materials sector.

However, more effective use of biomass through biorefinery is an absolute necessity to meet the overall 2030 LT Vision goals. Note that this only considers the needs of The Netherlands. However, because of the specific geographic position of The Netherlands, combined with the excellent logistical and industrial infrastructures in its harbour areas, the biorefinery processes will not only produce Bio-based Products and Bioenergy for the Dutch market, but also for export to external (European) markets. This adds to the envisaged scale size of biorefinery in The Netherlands. This will also contribute to maximise local value addition ("The Netherlands as BioHub for Europe").

Policy issues related to biomass, bioenergy or biorefineries

Biofuels - EC
2003: non-binding goal of 5.75% biofuels in 2010 (EC DIR 2003/30)
2008: 20% Renewable Energy in 2020, including 10% transportation fuels from renewable sources (biofuels, power, hydrogen). Additional sustainability criterium: at least 35% full chain greenhouse gas emission reduction (at least 50% in 2017).

Renewable Energy - NL
The Dutch Policy for renewable energy is defined by the Dutch Biomass Action Plan (goals see Table 2.) and the EC Directive on Biofuels (see alinea above).

Renewable Energy, Power and Heat
Biorefinery developments should substantially contribute to the 2007 Dutch programme *Clean and Efficient* ("Schoon en Zuinig", targeted at 2020). The major target defined within this governmental programme is 20% renewable energy in 2020. This national governmental target is higher than the goal for the Netherlands set by the EC, viz. 14% renewable energy in 2020 (corresponding to 17% in case the same definitions/approaches are taken into account).

Table 5. Key Targets ”Clean and Efficient”

Item	Target (PJ_{affu})
Biomass contribution in 2006	60
Biomass in 2020 according to *Clean and Efficient*	195 – 275
Biomass potential (including current usage) in 2020 according to the Option Document	230
Platform potential 2020	750
Platform ambition 2030	850

Further, 9% of the net electricity use in The Netherlands should be provided by renewables in 2010.

In 2009 a renewable heat regulation (part of the exploitation subsidy for the production of renewable power and gas, SDE) came into force, in which the production of renewable heat – a.o. from biomass – is supported by the Dutch government. By this regulation specifically the market competitiveness of biomass-based CHP plants (combustion, gasification, digestion) is improved.

Biofuels

Concerning biofuels for transport, for the Netherlands a blending directive of 5.75% in 2010 (EC: 2003/30/EG) was applicable. However, the Netherlands has decided to decrease this blending percentage in October 2008 to 4% - with minimally 3.5% for both gasoline and diesel – in 2010 due sustainability concerns.
In 2007 the Commission Cramer has developed set of sustainability criteria that have been integrated in NTA 8080 “Sustainability Criteria for Bioenergy”. These criteria will be used by the government to decide or a certain biofuel chain is sustainable or not, and if it will potentially be financially supported or not.
The long-term EC policy goal of 20% renewable energy in 2020 still is applicable, however, this includes both biofuels, renewable power, and hydrogen. In 2008, in the Netherlands a biofuel blending percentage of about 4% was realised.

The main national focus to further increase the biofuel use for transport will be on the implementation of advanced (2^{nd} and 3^{rd} generation) biofuel production facilities, viz. sustainable production facilities that i) do not compete with food/feed concerning their raw material use (a.o. ligno-cellulosic biomass) and ii) have a large overall greenhouse gas emission reduction potential over the full biomass-to-products chain. These plants likely will be some kind of biorefinery facilities, co-producing added-value bio-based products with the biofuels for transport (a.o. by upgrading process residues), to maximise overall process economics and to minimise the environmental impact.

Biorefinery related funding programs

The Dutch government has formulated a Vision on Biobased Economy (LNV, 2007) from which different ministeries have started funding schemes through an agency, Agentschap NL. Below these schemes are listed; more information can be found at www.agentschapnl.nl.

EOS LT Biorefinery
EOS-LT Biorefinery was a funding programme for long term fundamental research on biorefinery technology. In the period 2003-2009 several (smaller) projects have been granted:

- Biomass gasification and gas cleaning
- Biomass to Green Gas (BIOGG)
- Co-refining of biomass in existing refineries (CORAF)
- Green diesel from blue-green algae
- Maximising the bio-energy potential of ligno-cellulose
- N-ergy, microbiological co-production of N-chemicals and ethanol from biomass fractions
- Towards bioethanol from sugar beet pulp: The Pectin Challenge
- Value-added valorisation of lignin for optimal biorefinery of lignocellulose towards energy carriers and products (LignoValue)

Innovative Biofuels (IBB)
Funding programme initiated in 2006 – budget M€ 50 – on innovative biofuels for transport. First Tender in 2006 in which 4 initiatives were selected for funding (M€ 19.4).
A second Tender is expected for the second half of 2010, in which the biorefinery-approach will become part of the selection procedure.

TERM Biorefinery
The 'TERM Biorefinery' funding programme is part of the theme Renewable of the Innovation Agenda Energy. The programme supports pilot and demonstration projects in The Netherlands. These projects have to show that new biorefinery technology is able to supply industry and the energy sector with required feedstocks in a sustainable and economic way. The aim is to accelerate the application of biorefineries. The funding budget for 2010 is M€ 10. Projects that deal with growing biomass crops are excluded from the programme. On 8 July 2010, 12 Biorefinery Pilot/Demo plants have been granted by the Dutch Government within the TERM Biorefinery funding programme. The overall project budget contracted is M€ 12. More specifications on selected initiatives can be found in the table with Pilot/Demo plants.

SBIR
Earlier in 2008 and 2009 companies were supported concerning the development of new innovative products, processes and services through the Small Business Innovation Research (SBIR) programme. The list of supported projects – covering a.o.: agrologistics and biomass, cars of the future, innovative protein applications, reduction methane emissions from manure storages, biodiversity, green raw materials (incl. algae/seaweeds), biobased economy, hydrogen and fuel cells – can be found at: www.sbir.nl.

Running commercial biorefineries

Company	Feedstock	Products	Description	Size
BioMCN	Glycerin	Bio-methanol	Upgrading of the biodiesel byproduct glycerin to methanol for transport. Plant in Delfzijl opened officially on the 25th of June 2010. www.biomcn.eu	Production capacity of 250 million litres
Cargill	Wheat and corn	Starches, starch derivates, wheat proteins and glucose	Integrated biorefinery together with Royal Nedalco plant in Sas van Gent	
Ecoson - Vion	Waste meat industry	Biogas, CHP, biodiesel	Integrated production of biogas, CHP and biodiesel from animal waste. www.ecoson.nl	Production capacity per year: 9,000 MWh from biogas, 50,000 ton refined fat and 5,000 ton biodiesel
Greenmills	Waste frying fat/oil and food waste	Biodiesel, Bioethanol and biogas	Greenmills is a joint initiative of Rotie, Noba, Tankstorage Amsterdam, Biodiesel Amsterdam, Tank & truck cleaning Amsterdam and Orgaworld BV. The waste cooking oils – previously used for preparing French fries (chips) and similar fried snacks – will be collected, cleaned and processed further by Rotie BV to turn them into suitable raw materials for the biodiesel plant in The Port of Amsterdam (Hornhaven). www.greenmills.nl	Biodiesel 100 Mton = 113 Ml/a, Bioethanol 5 Ml/a and biogas 25 m^3/a
Royal Nedalco	Wheat (by-products of nearby Cargill plant)	Bioethanol		1st generation plant (2005): 2.2 Ml/a; 2nd generation plant (2007) 2.0 Ml/a
Vierhouten Vet BV (Biodiesel Kampen BV)	Waste oils / fats	Biodiesel	Waste plant oils and animal fats from the food industry are upgraded to biodiesel. The plant is in production since January 2007. www.vierhoutenvet.nl and www.biodieselkampen.com	In 2009 the production capacity was expanded to 100,000 tons of biodiesel

Demo and pilot plants

Company	Feedstock	Products	Description	Status (demo/pilot)
Gras- en Groenvoeders Hoogland Marrum, Grant Acces, PMF Machinefabriek Delfzijl BV, Sannovations BV, Stichting Courage, Eska Graphic Board BV, Beuker Vochtrijke Diervoeders BV, For Farmers BV, Cosun/Suikerunie, WageningenUR-FBR	Grasses and protein-rich agroresidues	Proteins (feed), fibres (paper/cardboard)	GRASSA !! – High-value sustainable protein and fibre based products from grasses and protein-rich agroresidues (beet leafs). Capacity pilot-plant: 1-5 tonnes fresh materials per hour. www.Grassanederland.nl	Pilot (2010 – 2012)*
CRODA, Umicore AG & Co. KG	Residual plant oils	Biobased polymers, coatings, chemicals and personal care products	CRODA – Green chemical intermediates for polymers by oleochemical biorefining. www.crodaoleochemicals.com	Pilot (2010 – 2012)*
Cosun, Gras- en Groenvoeders Hoogland Marrum BV	Beet	Food, feed, chemicals, materials and energy	COSUN – The unbeatable beet: Beet biorefining. Cosun processes about 75,000 ha (22-25 tonnes d.m. per ha/year) into sugars and animal feed. Within this pilot project they will valorise the whole beet plant, i.e. : the beet, the leafs and the carrots into food, feed, chemicals, materials and energy. www.cosun.com	Pilot (2010 – 2012)*
HyGear BV, WageningenUR-FBR, HynerGreen – Abengoa	Non-food biomass materials	Isopropanol, butanol, ethanol, hydrogen	BioChemBouw – Chemical building blocks from biomass. High efficient decentral continuous refining of biomass into added-value Biobased Products. www.hygear.nl	Pilot (2010 – 2012)*
Biomass Technology Group BV, Albemarle Catalysts BV, Rijksuniversiteit Groningen	Non-food biomass materials	Bulk chemicals and fuels	Bioliquids Refinery – Decentral bio-oil production via fast pyrolysis coupled to central biorefineries for further processing and/or clasical oil refineries for co-production of bulk chemicals (and fuels). The refinery route includes: the separation of chemicals from the hemicellulose and lignin fraction, hydrogenation of the lignin fraction, and fermentation of the cellulose fraction. www.btgworld.com	Pilot (2010 – 2012)*

Maris Projects, K.U. Leuven, FeyeCon	Organic waste water	Microalgae to Omega-3 and energy	Aquafarming – Algae production and refining for healty food, feed and fuels. www.maris-projects.nl	Demo (2010 – 2012)*
Photanol BV, University of A'dam, Voiht paper	Sunlight, CO_2, water	Lactic acid, ethanol, butanol or ethylene	Direct production of lactic acid from blue algae. Blue algae directly convert sunlight, CO_2 and water into lactic acid, ethanol, butanol or ethylene. In this pilot-project the Proof-of-Concept at a scale of 50 m^3 will be shown. http://staff.science.uva.nl/-arents/mmp/	Pilot (2010 – 2012)*
Millvision, Solidpack BV	Nature and verge grass	Fibres for paper and cardboard	Millvision/BIOCEL – Refinery of protein-poor nature and verge grass into cellulosic fibres and value-added Biobased Products by mild fractionation.	Pilot (2010-2012)*
Bumaga BV, Eska Graphic Board BV, SCA Packaging De Hoop, Smurfit Kappa Roermond Papier, Procede Twente BV	Waste water paper industry	Fatty acids	BUMAGA – Separation of added-value organic fatty acids from waste water paper industry. www.kcpk.nl	Pilot (2010-2012)*
OrgaWorld BV	Organic residues	NPK (fertiliser)	High energy-efficient NPK recovery from organic residues. Demo-plant: 8-10 kt product per year (90% d.b.) Part of the Greenmills Biorefinery in the A'dam harbour area. www.orgaworld.nl	Demo (2010-2012)*
Purac Biochem BV, Crown van Gelder NV, Bumaga BV	Residues paper industry	Lactic acid and its derivates	Lactic acid production from residues paper industry. Residues (a.o. cellulose) produced by a paper factory are separated and fermented to lactic acid and its derivates. Advantages: cost-savings paper industry and non-food raw material for fermentation industry. www.purac.com	Pilot (2010-2012)*
Ingrepo, TNO	Industrial waste water	Microalgae to Biobased Products and Bioenergy	AlgaePro-concept – industrial waste streams to algae biomass. Pilot-project: development of algae refinery concept. www.ingrepo.nl	Pilot (2010-2012)*
Avantium	Non-food biomass crops and residues	Furanics-based biopolymers and biofuels	Pilot-scale catalytic concersion hydrocarbons to furanics (PROOF), raw material for biopolymers and biofuels. Production of some 1000 kgs furanics for downstream application testing. www.avantium.com	Pilot (2010-2013)*
BE-Basic Research Consortium	Non-food biomass crops and residues	Biobased Products and Biofuels.	Modular multi-purpose Bioprocess Pilot Facility Delft, incl.: biomass pretreatment, fermentation, recycling and purification to third-generation bioprocesses. www.be-basic.org	Pilot (2010-unknown)

Wageningen University and Research centre (Wageningen UR)	Wastewater, CO_2, sunlight	Algae	ALGAEPARC - The goal of AlgaePARC (Algae Production And Research Centre) is to fill the gap between fundamental research on algae and full-scale algae production facilities. This will be done by setting up flexible pilot scale facilities to perform applied research and obtain direct practical experience. www.algae.wur.nl/UK/projects/AlgaePARC/	Pilot (2010-unknown)
CCL/Cehave, WageningenUR-FBR	Agroresidues	Animal feed and energy	Innovative Heat Treatment of agroresidues to produce specified animal feed fractions from agroresidues.	Pilot (2010-2012)

* On 8 July 2010, the realisation of 12 Biorefinery Pilot/Demo plants has been granted by the Dutch Government within the TERM Biorefinery funding programme.

Major RTD activities

Name of project	Type of project	National coordinator (representative)	Description	Duration	Size (€s, US$)
ASPECT	NL	NWO	The Advanced Sustainable Processes by Engaging Catalytic Technologies Programme (ASPECT) programme concentrates on commodity chemicals and catalysis with the aim of increasing sustainability. The goals as formulated in the program are largely based on the Report 'Catalysis, key to sustainability' of the Technology Roadmap Catalysis.	2004-2011	M€ 12.5
BE-Basic	NL, private public funding	Delft University of Technology	The Bio-Based Ecologically Balanced Sustainable Industrial Chemistry Programme (BE-Basic) supports the development of clean, robust and competitive biobased chemicals, materials and energy industries, including responsible monitoring and control of healthy soil and water environments, on the basis of advanced genomics technologies and bioprocess engineering. www.be-basic.org	2009-2014	M€ 120
BIOCOUP	EC	University of Twente	Co-processing of upgraded bioliquids in standard refinery units. www.biocoup.eu	2006 - 2009	M€ 7.6 (grant)
BIOPOL	EC	Wageningen University and Research centre (Wageningen UR)	Assessment of biorefinery concepts and the implications for agriculture and forestry policy. www.biorefinery.nl/biopol	2007-2009	M€ 0.7
BIOEF-INTEG	EC	Energy research Centre of the Netherlands (ECN)	Development of advanced biorefinery schemes to be integrated into existing industrial fuel producing complexes. www.bioref-integ.eu	2008-1010	M€ 1.4
BIOSYNERGY	EC	Energy research Centre of the Netherlands (ECN)	Biomass for the market competitive and environmental friedly synthesis of bioproducts and secondary energy carriers through the biorefinery approach. www.biosynerg.eu	2007-2010	M€ 13.4
CATCHBIO	NL, private public funding	Netherlands Institute for Catalysis Research (NIOK)	Catalysis for Sustainable Chemicals from Biomass Programme (CATCHBIO) aims to develop clean and efficient processes for biomass conversion into low-cost and sustainable biofuels, chemicals and pharmaceuticals.	2007-2010	M€ 29

OXYGREEN	EC	University of Groningen	Effective redesign of oxidative enzymes for green chemistry (OXYGREEN) aims at the design and construction of novel oxygenating enzymes for the production of bioactive compounds that can be used in medicine, food and agriculture. www.rug.nl/oxygreen/index	2008-2013	M€ 7.5
PROSUITE	EC	University of Utrecht	Development and application of standardized methodology for the PROspective SUstaInability assessment of Technologies (PROSUITE) will create a solid research basis for technology characterization, including theidentification of decisive technology features, basic engineering modules for estiamtions of material flows and energy use, and learning curves.	2009-2013	M€ 6.3
BIOCORE	EC	(WUR, ECN, DSM)	Development and demonstration of a Lignocellulosic Feedstock Biorefinery for the sustainable processing of agroresidues into second generation biofuels, bulk and fine chemicals, polymers, and energy.	2010-2013	M€ 20.2
STARCOLIBRI	EC	(WUR)	Promotion of the collaboration between complementary research projects in the field of biorefineries www.star-colibri.eu	2010-2012	M€ 2.4

Stakeholders

Name	Short Description
Industry	
ADM	www.adm.com
Akzo Nobel	www.akzonobel.com
Albermarle Cat.	www.albemarle.com
AquaPhyto	www.aquaphyto.com
Avantium	www.avantium.com
BASF	www.basf.nl
Beuker Vochtrijke Diervoeders BV	www.beuker.nl
BTG	www.btgworld.com
Bumaga BV	www.kcpk.nl/plone/bumaga
Cargill	www.cargill.nl
CCL / Cehave	www.ccl.nl
Cosun	www.cosun.com
CRODA	www.crodaoleochemicals.com
Crown van Gelder NV	www.cvg.nl
DOW Europe	www.doc.com
DSM	www.dsm.com
Eneco	www.eneco.nl
Eska Graphic Board BV	www.eskagraphicboard.com
FeyeCon	www.feyecon.com
For Farmers BV	nl.forfarmers.eu
Gras- en Groenvoeders Hoogland Marrum BV	www.grassanederland.nl
Hygear BV	www.hygear.nl
HynerGreen – Abengoa	www.hynergreen.com
Ingrepo	www.ingrepro.nl
Meneba	www.meneba.com
Millvision	www.millvisionweb.eu
OrgaWorld BV	www.orgaworld.nl
Photanol BV	www.photanol.nl
PMF Machinefabriek Delfzijl BV	www.pmf.nl
Procede Twente BV	www.procede.nl
Purac Biochem BV	www.purac.com
Port of Rotterdam	www.portofrotterdam.com
Royal Nedalco	www.nedalco.com
Sabic	www.sabic.nl

Sannovations BV	
Sasol	www.sasol.com
SCA Packaging De Hoop	www.scapackaging.com
Shell	www.shell.nl
Smurfit Kappa Roermond Papier	www.smurfitkappa-roermondpapier.com
Solidpack BV	www.solidpack.eu
Suikerunie	www.suikerunie.nl
Umicore AG & Co. KG	www.umicore.com
Unilever	www.unilever.nl
Voiht paper	www.voithpaper.com
Research Institutes	
Energy research Centre of the Netherlands (ECN)	www.ecn.nl
TNO	www.tno.nl
Wageningen University and Research centre (Wageningen UR) - FBR	www.fbr.wur.nl
Universities	
Delft University of Technology	www.tudelft.nl
Eindhoven University of Technology	www.tue.nl
University of Amsterdam (UvA)	www.english.uva.nl
University of Groningen	www.rug.nl
University of Leiden	www.leiden.edu
University of Utrecht	www.uu.nl
University of Twente	www.utwente.nl
Wageningen University	www.wageningenuniversity.nl
Governmental Organisations	
Ministry of of Agriculture, Nature and Food Quality	www.minlnv.nl
Ministry of Economic Affairs	english.ez.nl/english/organisation/index.htm
NL Agency	www.senternovem.nl
Non-governmental Organisations (NGOs)	
Greenpeace	www.greenpeace.nl
WWF	www.wnf.nl
Others	
Advanced Chemical Technologies for Sustainability (ACTS)	www.nwo.nl/acts
Biorefinery.nl	www.biorefinery.nl
Dutch Separation Technology Institute (DSTI)	www.dsti.nl

Knowledge Center Paper and Board (KCPK/VNP)	www.kcpk.nl
Product Board for Margarine, Fats and Oils (MVO)	www.mvo.nl
Netherlands Institute for Catalysis Research (NIOK)	www.niok.nl
Rabobank	www.rabobank.nl
Stichting Courage	
Netherlands Chemical Industry Association (VNCI)	www.vnci.nl
Dutch Petroleum Industry Organisation (VNPI)	www.vnpi.nl

Other issues/updates

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References

Annevelink, E., J. Broeze, R. van Ree, J.H. Reith & H. den Uil (editors), 2009. Opportunities for Dutch Biorefineries. Wageningen UR, ASG, Rapport 1022, 142 pp.

EZ, 2008. Innovatieagenda energie. Report, 117 pp.

LNV, 2007. Overheidsvisie op de bio-based economy in de energietransitie; 'de keten sluiten'. Report, 36 pp.

PGG, 2006a. Potential of Co-production of Energy, Fuels and Chemicals from Biobased Renewable Resources.

PGG, 2006b. Duurzame productie en ontwikkeling van biomassa, zowel in Nederland als in het buitenland (in Dutch). Report, August, 93 pp.

Rabou, L.P.L.M., E.P. Deurwaarder, H.W. Elbersen & E.L. Scott, 2006. Biomass in the Dutch Energy Infrastructure in 2030. Platform Biobased Raw Materials, January 2006, 54 pp.

Koppejan J., Elbersen H.W., Meeusen M., Bindraban P., Beschikbaarheid van Nederlandse Biomassa voor Elektriciteit en Warmte in 2010. SenterNovem, November 2009, 99 pp. (in Dutch).

Meesters K., Boonekamp P., Meeusen M., Verhoog D., Elbersen H.W., Monitoring Groene Grondstoffen. Platform Groene Grondstoffen, januari 2010, 108 pp. (in Dutch).

VROM, 2009 Report concerning Directive 2003/30/EG, August 2010.